

JAN 17 2008

PATENT APPLN. NO. 10/809,842
SUBMISSION UNDER 37 C.F.R. § 1.114

PATENT

REMARKS

Initially, applicants would like to thank the Examiner in charge of the present application, Examiner Tracy Dove, for the courteous and helpful telephone interview extended to applicants' undersigned representative on December 11, 2007. The substance of the interview is summarized in an Interview Summary sent to applicants' representative by Examiner Dove via e-mail on December 12, 2007. A copy of the Interview Summary is attached to the present paper to be entered into the record of the present application. The Interview Summary is not currently part of the Image File Wrapper of the application as available through the Private PAIR system.

In the present paper, claim 1 has been amended to include the limitations of claims 3 and 7. I.e., claim 1 has been amended to recite that vinyl ethylene carbonate in a range of 0.1 ~ 5 parts by weight per 100 parts by weight of the nonaqueous electrolyte and vinylene carbonate or a derivative of vinylene carbonate in a range of 0.1 ~ 5 parts by weight per 100 parts by weight of the nonaqueous electrolyte are included in the nonaqueous electrolyte. Claims 3, 5, 7, 19 and 20 have been canceled.

In the Final Action of July 17, 2007, the Office maintained the rejections of the claims under 35 U.S.C. § 103(a) as being

obvious over Hatazaki et al., US 2001/0038949 ("Hatazaki") and over Hatazaki in view of Kameda et al., US 6,632,569 ("Kameda") that were made in the Action of January 26, 2007. In the Final Action the Office identified Hatazaki as disclosing a nonaqueous electrolyte secondary battery meeting the limitations of claim 1 except that sulfolane is not contained in the electrolyte of Hatazaki in an amount of 20 - 45 % by volume, on the basis of the total volume of the solvent. The position of the Office is that modification of the electrolyte of Hatazaki to contain the claimed range of sulfolane amounts to routine optimization.

In the response filed November 19, 2007, to the Final Action applicants traversed the rejections as being improper for the reasons explained below. The Office maintained the 35 U.S.C. 103(a) rejections in an Advisory Action dated November 30, 2007, but no reasons for maintaining the rejections were provided. In the telephone interview on December 11, 2007, applicants' representative requested Examiner Dove to provide reasons for maintaining the rejections. Examiner Dove kindly provided her reasons for maintaining the rejections in the Interview Summary.

Regarding the response filed November 19, 2007, applicants argued, first, that a person of ordinary skill in the art would not have been motivated to modify the battery of Hatazaki to increase

the amount of sulfolane to an amount of more than 10 parts by weight because Hatazaki teaches away from the use of an amount of the additive (i.e., sulfolane) of more than 10 parts by weight.

Applicants noted that the amount of sulfolane of 20 ~ 45 volume %, on the basis of the total volume of the solvent, as recited in claim 1 of the present application, is significantly greater than the upper limit of 10 parts by weight of sulfolane per 100 parts by weight of the nonaqueous electrolyte as described in Hatazaki. In support of this position, applicants provided calculations converting parts by weight of sulfolane per 100 parts by weight of relevant nonaqueous electrolytes of Hatazaki to volume %, on the basis of the total volume of the solvent, as used in the present application. The calculations showed that 0.1 to 10 parts by weight of sulfolane per 100 parts by weight of the nonaqueous electrolytes is the same as 0.099 - 10.2 volume %, on the basis of the total volume of the solvents in the electrolytes.

In the Interview Summary, the Office takes the position that the calculations are "flawed". The basis for this position is stated to be that it is unclear how applicant concludes that 0.1 to 10 parts by weight of sulfolane corresponds closely to an amount of 0.1-10% "because parts by weight per parts by weight of the electrolyte (salt and solvent) is not equivalent to a volume

percent based on the volume of solvent (only part of the electrolyte)."

Applicants do not understand the Office's position and do not believe that the Office is correct. The calculations provided in the response filed November 19, 2007, convert parts by weight of sulfolane per parts by weight of the electrolyte to volume percent of sulfolane based on the volume of solvent in the electrolyte.

For the convenience of the Office, the calculations explained in the response are reproduced below:

"Applicants note that because the specific gravity of sulfolane is not large, 0.1 to 10 parts by weight of sulfolane per 100 parts by weight of the nonaqueous electrolyte disclosed in Hatazaki corresponds closely to an amount of 0.1-10% by volume based on the volume of solvent of the nonaqueous electrolyte. This is demonstrated on the basis of the following calculations.

In Examples 1, 2 and 3 of Hatazaki, the use of an electrolyte of 1 mol/l of LiPF₆ in a mixed solvent containing ethylene carbonate (EC) and ethylmethyl carbonate (EMC) in a volume ratio of 1:3 is described. (These examples include Battery No. 31 in which sulfolane is used as an additive in an amount of 2 parts by weight). The specific gravity of this electrolyte is 1.237 g/cm³, which is obtained using a molecular weight of LiPF₆ of 151.9, a specific gravity of EC of 1.322, and a specific gravity of EMC of 1.007. For 1 l of the electrolyte, 250 ml of EC and 750 ml of EMC are mixed (EC/EMC (1/3)). The weight of EC is about 330 g (250 ml x 1.322), and that of EMC is about 755 g (750 ml x 1.007). The electrolyte includes LiPF₆ at a concentration of 1 mol/l, i.e., 151.9 g/l. Therefore, the weight of 1 l of the electrolyte is about 1,237 g (330 g + 755 g + 151.9 g), and, therefore, the specific gravity of the electrolyte is 1.237 g/cm³.

If 0.1 - 10 % by weight of sulfolane (SL) is added to 1 l of the electrolyte (i.e., 1,237 g of electrolyte), the weight of the added SL is from 1.237 g to 123.7 g. The volume of 1.237 g to 123.7 g of the SL is $1.237 \text{ g} / 1.254 = 0.986 \text{ ml}$ to 98.6 ml (where 1.254 is the specific gravity of SL). 0.986 ml to 98.6 ml of SL is equivalent to 0.099 - 9.9 % by volume $((0.986 - 98.6 \text{ ml}) / 1,000 \times 100)$.

With respect to the electrolyte of Battery 42 in Example 4 of Hatazaki, which electrolyte appears to be the closest electrolyte to the preferred electrolyte of the present invention, the volume % equivalent to 0.1 - 10 % by weight of SL can be calculated in the same way as explained above.

The specific gravity of the electrolyte used for Battery 42 is 1.289 g/cm³ which is obtained using a molecular weight of LiPF₆ of 151.9, a specific gravity of GBL of 1.125, and a specific gravity of VC of 1.355.

If 0.1 - 10 % by weight of SL is added to 1 l of the electrolyte (i.e., 1,289 g of electrolyte), the weight of the added SL is from 1.289 g to 128.9 g. The volume of 0.1 - 10 % by weight of the SL is $1.289 \text{ g} / 1.254 = 1.02 \text{ ml}$ to 102 ml (where 1.254 is the specific gravity of SL). 1.02 ml - 102 ml of SL is equivalent to 0.10 - 10.2 % by volume of the electrolyte.

The undersigned believes that the volume % of sulfolane in other combinations of solvents useful as the electrolyte in Hatazaki will not be materially different from the amount of sulfolane in parts by weight."

As can be seen from the above calculations, the electrolyte used in Examples 1, 2 and 3 of Hatazaki which includes 1 l of solvent has a weight of 1,237 g. Therefore, 0.1 - 10 % by weight of SL added to 1,237 g of the electrolyte, i.e., added to 1 l of solvent, is from 1.237 g to 123.7 g in terms of weight and 0.986 ml to 98.6 ml in terms of volume. In terms of percent by volume of SL based on

the volume of solvent, 0.986 ml to 98.6 ml of SL is equivalent to 0.099 - 9.9 % by volume, i.e., $((0.986 - 98.6 \text{ ml}) / 1,000 \text{ ml}) \times 100$. (It is noted that if the volume of the SL is added to the volume of the mixed solvent, the total volume of solvent would be greater and thus the volume percentages of SL would be even smaller.

Therefore, applicants' calculations properly show that the amount of sulfolane disclosed as being useful as an additive in the electrolyte of Hatazaki corresponds to a range of about 0.10 to 10 volume %, based on the volume of the solvents, if added to the electrolytes in Examples 1-4 of Hatazaki.

If the Office maintains its position that applicants' calculations are flawed, it is respectfully requested to identify specific errors in the calculations.

Applicants argued, second, that Hatazaki teaches away from increasing the amount of sulfolane above 10 parts by weight since such an increase would result in deterioration of discharge characteristics. Hatazaki discloses that if the additives are used in an amount of more than 10 parts by weight, discharge characteristics are deteriorated. Specifically, paragraph [0049] of Hatazaki, describes that "if the amount thereof [e.g., SL] is more than 10 parts by weight, the coating film formed on the electrode becomes too thick, thereby deteriorating the discharge

characteristics." Applicants asserted that this description "teaches away" from increasing the amount of sulfolane to an amount equivalent to the amount of 20 - 45 volume %, on the basis of the total volume of the solvent, required by the claims of the present application.

In response to this argument, the Office states in the Interview Summary that paragraph [0011] of the specification of the present application teaches that the coating is the result of the carbonic acid ester and not the sulfolane and, therefore, the "Examiner does not believe that Hatazaki teaches away from the claimed invention." (Interview Summary, page 2, penultimate paragraph, last sentence).

Applicants respectfully submit the applicants' disclosure is not prior art (and cannot be relied on by the Office) and is otherwise irrelevant to the issue of whether HATAZAKI teaches away from the claimed invention.

As noted in the response to the Final Action, the Federal Circuit has explained that "[a] reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant." *In re Kahn*, 441 F.3d at 990 (quoting *In re*

Gurley, 27 F.3d 551, 553 [31 USPQ2d 1130] (Fed. Cir. 1994)) (internal quotation marks omitted). (Emphasis applicants'). Applicants respectfully submit that a person of ordinary skill in the art, upon reading Hatazaki and, specifically, upon reading the description in paragraph [0049] of Hatazaki that "if the amount thereof (SL) is more than 10 parts by weight, the coating film formed on the electrode becomes too thick, thereby deteriorating the discharge characteristics," would be discouraged from following the path set out in the reference, i.e., would be discouraged from increasing the amount of sulfolane.

A reference that teaches away from a given combination negates a motivation to modify the prior art to meet the claimed invention. See, e.g., *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 [77 USPQ2d 1865] (Fed. Cir. 2006). Therefore, Hatazaki also negates the motivation, i.e., routine experimentation, suggested by the Office in the Final Action, to increase the amount of sulfolane in the battery of Hatazaki.

Applicants note that the present invention has been developed focusing on the high boiling point of sulfolane, i.e., 287 °C, which is higher than that of other solvents. When sulfolane is added to an electrolyte of a secondary battery in a range of 20 -45

% by volume, it has been found that it contributes to a significant improvement in the safety of the battery.

Sulfolane generally has problems such as compatibility with a graphite negative electrode, and having a high freezing point of 28 °C (see paragraph [0004] of the specification). In the past, it had been difficult to use 10 % by volume or more of SL as a solvent.

The present invention was made on the basis of founding that a non-aqueous electrolyte secondary battery which includes an electrolyte containing sulfolane in a range of 20- 45 % by volume, on the basis of the total volume of solvent, and a negative electrode which includes a carbon material, has excellent charge and discharge characteristics when an additive of vinylene carbonate (VC) and vinyl ethylene carbonate (VEC) is added to the electrolyte in an amount of 0.1 ~ 5 % by weight. (Refer to the data in Table 1 in the specification). These results cannot be reasonably unexpected from the disclosure of Hatazaki which specifically indicates that discharge characteristics will be deteriorated if the amount of sulfolane is increased above 10 % by weight and which discloses nothing concerning the advantageous effect of including vinylene carbonate (VC) and vinyl ethylene

PATENT APPLN. NO. 10/809,842
SUBMISSION UNDER 37 C.F.R. § 1.114

PATENT

carbonate (VEC) in an electrolyte containing an amount of sulfolane of greater than 10% by weight.

For these reasons, Hatazaki does not support a case of prima facie obviousness of the non-aqueous electrolyte secondary battery of the present invention and removal of the 35 U.S.C. 103(a) rejections of the claims is in order.

In the event that this paper is not considered to be timely filed, applicants hereby petition for an appropriate extension of time. The fee for any such extension may be charged to our Deposit Account No. 111833.

In the event any additional fees are required, please also charge our Deposit Account No. 111833.

Respectfully submitted,
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Attachment: Interview Summary (of interview on December 11, 2007)

JAN 17 2008

Interview Summary	Application No.	Applicant(s)
	10/809,842	KIDA ET AL.
	Examiner	Art Unit
	Tracy Dove	1795

All participants (applicant, applicant's representative, PTO personnel):

(1) Tracy Dove

(3) _____

(2) Ron Kubovcik

(4) _____

COPYDate of Interview: 11 December 2007.Type: a) Telephonic b) Video Conference
c) Personal [copy given to: 1) applicant 2) applicant's representative]Exhibit shown or demonstration conducted: d) Yes e) No.

If Yes, brief description: _____

Claim(s) discussed: 1.Identification of prior art discussed: Hatazaki.Agreement with respect to the claims f) was reached g) was not reached h) N/A.Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: See Continuation Sheet.

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

THE FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has already been filed, APPLICANT IS GIVEN A NON-EXTENDABLE PERIOD OF THE LONGER OF ONE MONTH OR THIRTY DAYS FROM THIS INTERVIEW DATE, OR THE MAILING DATE OF THIS INTERVIEW SUMMARY FORM, WHICHEVER IS LATER, TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. See Summary of Record of Interview requirements on reverse side or on attached sheet.

Examiner Note: You must sign this form unless it is an attachment to a signed Office action.

Examiner's signature, if required

COPY

Continuation of Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments:

Applicant requested Examiner provide the reasons for maintaining the rejection and issuing the Advisory Action of 11/30/07. Applicant's response of 11/19/07 contained arguments attempting to distinguish the claimed invention over Hatazaki. These arguments were not found persuasive by the Examiner because Hatazaki is not limited to any of the disclosed examples or any particular embodiment. Applicant asserts that because the specific gravity of sulfolane is not large, 0.1 to 10 parts by weight of sulfolane per 100 parts by weight of the nonaqueous electrolyte disclosed in Hatazaki corresponds closely to an amount of 0.1-10% by volume based on the volume of solvent on the nonaqueous electrolyte. However, it is unclear how Applicant reaches this conclusion because parts by weight per parts by weight of the electrolyte (salt and solvent) is not equivalent to a volume percent based on the volume of solvent (only part of the electrolyte). Since the calculations regarding the examples are based on this assertion, the calculations are considered flawed and are not found persuasive

Furthermore, the courts have held that a limitation merely with respect to proportions will not support patentability in the absence of unexpected results. Hatazaki discloses a battery having excellent charge/discharge characteristics and a long cycle life while generating a smaller amount of gas during storage than conventional batteries (abstract). An object of the present specification is to improve the charge and discharge characteristics of a battery (0008). Applicant has not provided evidence of unexpected results that would distinguish the assertion that Hatazaki teaches at most 10 vol% of sulfolane and the claimed invention reciting at least 20 vol% of sulfolane

Applicant has narrowly defined the term "additive", which is improper. The term "additive" is broadly used in the art and is not defined as "a relatively minor amount". Examiner does not believe one of skill in the art would consider 10 wt% a minor amount.

Applicant refers to [0049] of Hatakai that discusses a coating film being formed on the electrode. Examiner points to [0011] of the present specification that discusses the formation of a coating film formed on the surface of the electrode. This film appears to be the result of the amount of the carbonic acid ester and not the sulfolane. Therefore, Examiner does not believe that Hatazaki teaches away from the claimed invention.

Applicant argues Hatazaki does not disclose or suggest anything relating to improving safety, while the present invention focuses on the high boiling point of sulfolane. However, Hatazaki discloses less gas is generated in the battery of Hatakaki. The use of sulfolane and vinylene carbonate solvents together in a nonaqueous battery containing a negative electrode made of carbon material is disclosed by Hatazaki.

Summary of Record of Interview Requirements

COPY

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111-1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.

All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:

- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (If Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

- 1) A brief description of the nature of any exhibit shown or any demonstration conducted.
- 2) An identification of the claims discussed.
- 3) An identification of the specific prior art discussed.
- 4) An identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner.
- 5) a brief identification of the general thrust of the principal arguments presented to the examiner.
(The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
- 6) a general indication of any other pertinent matters discussed, and
- 7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.